

(14)

ON OBSTRUCTIVE SUPPRESSION OF URINE.

BY WILLIAM ROBERTS, M.D., F.R.C.P.,
PHYSICIAN TO THE MANCHESTER ROYAL INFIRMARY.

SUPPRESSION of urine arises under two distinct classes of circumstances. In one it arises from disease of the renal tissue, or from some disturbance in the circulation or innervation of the kidneys, and not from any impediment to the discharge of urine. These have been called cases of *ischuria renalis*, or *anuria renalis*. Cases of this class occur in the various forms of Bright's disease, in the algide stage of cholera and ague, and in severe collapse or shock from any cause.

The second class of cases includes those in which there is no primary defect in the kidneys nor in their vascular or nervous supply; but in which the suppression is due to some mechanical obstruction in the ureter or pelvis of the kidney, which impedes the outflow of urine. These may be called cases of *obstructive suppression*. In the last three years I have encountered a somewhat unusual number of cases of this class, and their study has indicated certain points of clinical and pathological interest which appear worthy of attention. Three of these cases have already been published in the weekly journals,* but as they appeared separately, and at intervals, I have thought it desirable to bring them together, and to add to them the cases I have observed since, for the purpose of more comprehensive examination.

The most common case of obstructive suppression is the impaction of a stone in the ureter of a person who has only one kidney, or, at least, only one capable of secreting urine. Sometimes one of the kidneys is congenitally absent; or it has been

* 'Lancet,' 1868, i; *Ibid.*, 1870, i; also 'Brit. Med. Journ.', vol. i, 1868.

permanently disabled at some preceding period of life by the lodgment of a stone in its ureter, or by some other accident or disease. The next most common case is the blocking up of the terminal portions of the ureters by the progress of a morbid growth, involving the trigone of the bladder. The less frequent cases depend on some congenital malformation of the ureters, or of the renal arteries, whereby an impediment is constituted to the outflow of urine. This may be slight at first, but in process of time it becomes progressively greater, until at length it arrests the secretion of urine. Examples of these three modes of obstruction will be found among the following cases.

A case of suppression from obstruction seldom reaches a fatal climax without some urine having been voided during its course; it may be a few ounces, or it may be a few pints. The character of this urine is distinctive, and I wish particularly to insist on this as a diagnostic mark which serves to distinguish obstructive suppression from renal suppression, or *ischuria renalis*. In the latter class of cases there is a certain congruity between the state of the urine and the general condition of the patient. As a rule the urine is deeply coloured and concentrated, or it bears unmistakable marks of the disease under which the patient is labouring —*i.e.*, it contains albumen and casts. But in obstructive suppression the urine which escapes past the obstruction is markedly pale and watery, and of very low density. It may accidentally be coloured by blood, but it is defective in the proper urinary pigment, and, as a rule, is free from albumen.

This peculiarity depends on the physical conditions under which the urine in these circumstances is secreted. In order to understand the matter clearly it will be necessary to call to mind the mutual relations in health of the blood circulating in the renal arteries and the urine newly secreted from it, and flowing down the uriniferous canals. In the normal state, the limiting membrane intervening between the blood circulating in the Malpighian tufts and around the convoluted tubes on the one hand, and the urine in the uriniferous canals on the other, is subject on the side of the blood to a considerable pressure, namely, the lateral pressure within the arterial system; while on the other side there is

no counter-pressure at all so long as the escape of urine is free.

This inequality of pressure, as was first suggested by Ludwig, and afterwards experimentally proved by Hermann,* is a capital factor in the production of the urinary secretion. Hermann (operating on animals) found that when the pressure within the renal artery was lowered the flow of urine was proportionately diminished. He tested this point in two ways. In the first set of experiments he lowered the blood-pressure in the kidney by contracting (by a clamp) the calibre of the renal artery. In the second set he created a counter-pressure in the uriniferous canals by impeding the flow of urine by means of a column of mercury communicating with the ureter. By this latter method he exactly imitated the condition produced when the ureter is blocked up by a stone, or some other mechanical obstruction. Hermann found that a pressure in the ureter of 10 millimetres of mercury (0·4 inch) caused a sensible diminution in the flow of urine; this diminution went on progressing up to a pressure of 50 millimetres; and with a pressure of 60 millimetres of mercury (2·4 inches) the secretion of urine was altogether arrested. In these experiments the specific gravity and coloration of the urine are not alluded to, but it was uniformly found that the per-cent age of urea progressively diminished as the pressure in the ureter increased.

Basing our deductions on the clinical facts to be presently adduced, and fortified by the results obtained experimentally by Hermann, we may assume that a mechanical obstruction in the ureter will inevitably produce the following series of events:—As soon as the obstruction is established the urine begins to accumulate above it; the accumulating urine determines an upward pressure first in the ureter, then in the pelvis of the kidney, and ultimately in the uriniferous tubes. As the urine goes on accumulating the pressure within these channels necessarily increases, until at length the pressure so created is sufficiently great in the uriniferous canals to counterpoise the pressure within the renal blood-vessels. When this point is reached the secretion of urine

* Henle and Pfeuer's 'Zeitschrift,' 1862, p. 1.

is arrested and total suppression ensues. If, again, the obstruction be not altogether complete, and there be room for some urine to escape past the obstacle, the urine so escaping will have been secreted under a high pressure within the uriniferous canals, and its constitution will be found thereby materially altered; it will be very pale, watery, devoid of its proper colouring matter, poor in urea, and of low specific gravity. It may, indeed, be tinged with blood, but this is an accidental circumstance.

Another point with regard to the urine in obstructive suppression is the irregularity of its times of emission. In nearly all the cases this is a marked peculiarity. One day there will be an emission, the next day none, or perhaps none for two or more days, and then again a return of the flow, and again an arrest. This point will be again adverted to.

The long delay of characteristic symptoms is also a striking circumstance. When even the suppression is absolute, seven or eight days elapse before the special symptoms of uræmia make their appearance, but when these do appear the end approaches rapidly, and death is not delayed beyond two or three days. Up to the rise of the proper uræmic symptoms the condition of the patient is, as a rule, wonderfully calm and free from distress. There may be more or less gastric disturbance and insomnia, and diminution of the muscular strength, but the functions generally proceed tranquilly, and the intelligence is undisturbed.

The most distinctive and invariable of the special uræmic signs are muscular twitches. I believe that these are never wanting. Contraction of the pupils is also a constant sign, but later in its development than muscular twitches. Rapidly increasing muscular weakness is also constantly witnessed, and as this invades the respiratory muscles the breathing becomes markedly slow, panting, and laborious. The tongue and palate become quite dry in the two or three last days. The cerebral functions are much less involved than might be expected. There is increasing drowsiness, with short, fitful snatches of sleep, and a little rambling delirium, but absolute coma rarely supervenes, and convulsions are quite exceptional. The intellect is more commonly preserved to the last, and in more than one instance the patient has spoken sensibly the

instant before death. Diarrhoea (unless produced artificially) is quite exceptional, so likewise is excessive vomiting. There is never any dropsical symptom. The skin is commonly moist, often sweating profusely. There is never any ammoniacal or urinous odour from the breath or skin, nor from the body after death.* The power of taking food varies : as a rule it is moderate up to an advanced stage, but complete anorexia comes on a day or two before death.

There are some other points relating to the morbid anatomy—the survivorship and the treatment which will be more conveniently noticed in the way of comment on the particular cases, or in the concluding part of the paper.

CASE 1.—A man, aet. 67, who twelve years before had suffered from symptoms of renal colic, but had not passed any stone, was attacked about six weeks before his death with symptoms of left renal calculus, with frequent micturition and pains in the left loin, &c. A fortnight before his death, after a long walk, he felt a sudden access of intense pain in the left loin. This continued in great severity for four days, and was accompanied with very frequent and scanty micturition. At the end of these four days the urine became altogether suppressed, and the pain ceased a few hours after. On the third day of complete suppression I saw the patient. He had absolutely no symptoms referable to the suspended urinary function ; he was calm, free from pain, also from nausea and vomiting, without desire to void urine ; pulse 80 ; tongue clean ; skin dry ; he had had no sleep for two nights. He was ordered a warm bath, a saline mixture, and to have the course of the left ureter well kneaded with the aid of a liniment. Next day (fourth day of suppression) he passed a pint of pale, limpid urine ; he had perspired freely and slept some hours. On palpating the renal regions the right was felt to be flat and empty, contrasting with the left which presented its natural roundness and sense of resistance. The following diagnosis was made—absence or atrophy of the right kidney and impaction of a calculus in the left ureter.

* This seems a point of distinction from *retention* of urine.

On the next day (fifth) twelve ounées of urine were voided. It was clear, almost colourless, sp. gr. 1010, not albuminous, and contained 1.92 grains of urea per ounée. There was anorexia, thirst, nausea, and occasional vomiting, a slight sense of mental confusion, but no actual delirium; pulse 80; respiration 24.

On the following day (sixth) the same symptoms continued with intense restlessness and insomnia. Sixteen ounées of colourless urine were passed, sp. gr. 1011, containing 2.08 grains of urea per ounée. The following new symptoms also showed themselves—dryness of tongue at tip, contraction of pupils, and occasional hiccough. In the evening of this day six more ounées of limpid urine were voided; sp. gr. 1011; temperature in axilla 98.6°.

On the afternoon of the next day (seventh) a great change for the worse was observed. Pulse 80, irregular; respiration 20, laboured, long-drawn, interrupted; tongue dry and brown; frequent muscular twitches all over body; patient indifferent and drowsy, but answering questions intelligently; no urine for the last eighteen hours.

Death took place thirty-six hours after the last visit—exactly nine and a half days from the commencement of the suppression. The symptoms during this last period, as observed by Mr. Mellor, with whom I saw the case, were—increasing laboriousness and slowness of the respiration, which assumed a panting character; deepening indifference, but still he answered “yes” and “no” to questions addressed to him, though slowly and unwillingly; pupils contracted to pins’ points; finally complete coma. There was a doubtful convulsive seizure immediately before death.

Autopsy.—Strong rigor mortis; body well nourished and quite free from urinous or ammoniacal odour. All the organs healthy except the kidneys and ureters. The *right kidney* was wholly converted into a fibrous mass, studded with cysts, and weighed two and a half ounées. The corresponding ureter was impervious throughout, and changed to a fibrous cord, which was thickened about the middle to double its width. This thickened part was solid and fibrous like the rest. No stone existed in any part of the ureter or kidney, but it was conjectured that the thickened part of the ureter had been the seat of an obstruction, and that

the stones, or whatever object had constituted the obstruction, had been subsequently removed by absorption.

The *left kidney* was much enlarged, it weighed ten ounces, and, on section, appeared dark and intensely congested. The ureter was as thick as a goose-quill, and distended with fluid. At its lower part were found three little oxalate-of-lime calculi about the size of hemp-seeds, and weighing altogether one and a half grains. One of these was tightly impacted in the terminal part of the ureter, where it passes through the coats of the bladder; this was the cause of the obstruction. The fluid imprisoned in the ureter amounted to three drachms, and consisted of grumous bloody urine. The pelvis of the kidney was only slightly dilated, and contained about two drachms of bloody urine.

The bladder contained about six ounces of pale dilute urine; its coats were healthy.

The course of events in this man appears to have been the following:—About a month before the patient came under observation three small calculi, which had been previously lying harmlessly in one of the infundibula, were dislodged, and fell into the pelvis of the kidney. Here they sojourned some four weeks, causing pains in the left loin and frequent micturition. At the end of this period they suddenly entered the ureter, and for four days, amid great suffering, continued their descent to its lower part. Here the foremost calculus became impacted, the pain ceased suddenly, the passage of urine was blocked up, and suppression ensued. Had the opposite kidney been intact no serious consequences would have followed. The healthy kidney would have become proportionately hypertrophied and performed double duty. But the right kidney was, by an untoward coincidence, practically non-existent. It had itself, as may be conjectured, many years before, passed through a train of events similar to that which had now extinguished the activity of its fellow.

The suppression of urine in this case lasted nine days and a half. During the first three days the suppression was complete. Then followed a period of four days, during which an aggregate quantity of fifty-four ounces of urine were voided. Finally, in the last two

and a half days no urine was passed, but six ounces were found in the bladder after death, making a total of sixty ouncees of urine secreted in nine days and a half. This seems at first sight a not inconsiderable quantity, and causes surprise that, suppression being so incomplete, life was not longer maintained. But on closer inquiry the suppression proves to have been more complete than at first appeared. The urine discharged was exceedingly dilute, its sp. gr. ranged from 1010 to 1011, and its proportion of urea was only about two grains per ounce; this gives a total weight of urea excreted in nine and a half days of only 120 grains, which is less than one fourth of the normal amount for a single day.

CASE 2.—A very stout, tall man, æt. 59, suffered four years before from symptoms of the passage of ealeuli from the left kidney. Two small uric-acid stones were passed after several weeks of suffering, and then the symptoms subsided.

After four years of good health the patient was seized one morning, without assignable cause, with sudden pain in the right loin and urgent desire to pass water. The pain and urgency of micturition continued until the afternoon, and small quantities of bloody urine, amounting altogether to about half a pint, were voided at short intervals during the day. The stomach was irritable throughout the day. Towards evening the flow of urine ceased entirely and the pain diminished.

I saw the patient for the first time about fifty hours after the commencement of the suppression, with Mr. Grindrod, of New Mills; and I visited him daily until his death, which took place nine days and a few hours after the arrest of the urinary flow. During this period he only voided urine once, namely, two ouncees on the fourth day, and none was found in the bladder after death. This specimen of urine was quite characteristic of obstructive suppression. Its sp. gr. was 1010; it contained a little blood and a slight corresponding trace of albumen. When the blood-corpuscles had subsided the urine had a pale straw colour, and the deposit contained, besides blood-diseases, a large number of epithelial cells of a transitional character, resembling those of the pelvis of the kidney.

The case, which was closely watched throughout its course, presented a typical example of death from pure anuria. Dr. Garrod was telegraphed for from London, and joined our consultation on the fifth day of suppression.

For the first six days the symptoms were marvellously slight, and yielded but faint indications that one of the capital functions of the body was in absolute abeyance. The muscular strength had indeed declined, and the sleep was bad, but the patient was calm; his tongue, skin, and pupils were natural; there was little nausea and no vomiting after the fourth day; the intellect was unclouded; there was not the least urinous or ammoniacal odour about the breath or sweat; the pulse was steady, at about 72, the respirations 24, and the temperature scarcely varied from the normal limits. There was no desire to make water, scarcely any pain or tenderness in the right loin, and he continued to take a fair amount of nourishment. On the seventh day the characteristic symptoms of suppression began to show themselves. On this day occasional slight twitchings or pluckings of the muscles were observed on the trunk and limbs, and the tongue began to be dry. The insomnia, which had been a marked symptom from the first, became very distressing; he dozed frequently for short periods, and started on falling asleep and awaking. He took nourishment fairly, and had no vomiting or thirst, and only very slight and transient nausea.

On the eighth day the patient was still calm and quite free from mental confusion or indifference when fairly awake, but when left alone he was constantly falling off into a fitful doze, and awaking with a start. The muscular twitchings were more marked than yesterday, and the muscular weakness had increased greatly; nevertheless he was up and dressed in his bedroom for an hour and a half. The pupils were natural, and he took his food pretty well, a quart of milk, some cocoa and bread and butter, and rice pudding. The skin has acted profusely from the beginning in response to warm baths. No nausea or vomiting. A peculiar panting character of the respiration was noticed to-day, which became more and more pronounced until his death. The temperature also began to fall.

On the ninth day the patient's condition changed greatly for the

worse. The insomnia and restlessness were most distressing; the twitchings of the muscles very frequent and severe; the tongue and mouth were perfectly dry; the pupils were decidedly contracted, though still sluggishly responsive to light; thirst was troublesome and the appetite quite gone; the weakness was so great that he could not walk without the help of two assistants; his legs had to be lifted into the bath. There was no persistent nausea, but he vomited after a compound jalap powder. Although his intellect was clear when he was roused (he transacted some business with his lawyer) there was marked indifference when he was left undisturbed, and he lapsed at once into a dozy state, lying with his mouth open and jaw half dropped, breathing pantingly with long pause between expiration and inspiration.

On the tenth day, at one p.m., the patient died, having lived for a little more than nine whole days from the onset of the suppression, and having voided in this interval only two ounces of a very dilute urine.

The incidents of the closing scene were very distressing. The weakness increased rapidly; the night was most restless; the patient was constantly getting up to have a stool, but voided nothing except a little mucus. The thirst, dryness of the mouth and the muscular twitchings went on increasing. At six a.m. the breathing became very embarrassed, threatening suffocation. He asked to be instantly raised on the side of the bed into a sitting posture. He then belched up a large quantity of flatus, and was thereby much relieved in his breathing. After a couple of hours he lay down again, but with his head raised. The power of his legs was now quite gone; he said he could not feel them. At nine o'clock the pulse was 80, respirations 15, very laboured and interrupted. The pupils were strongly contracted. The twitchings were incessant all over the body and limbs. The breathing becoming again more embarrassed, he was lifted on the side of the bed, and finally into his arm chair. His strength failed now more and more, and the breathing became more and more difficult, and the uneasiness and distress increased, dozing and starting incessantly. He remained in his chair until one o'clock, when he began to slide off, and while

about to be assisted up again, he asked to have his hands rubbed, and suddenly fell back dead. There was no coma or convulsion throughout. He appeared to wander at times through the night, but when his attention was roused, he showed unshaken consciousness and intelligence to the end. The character of his breathing in the last two days was peculiar, and became increasingly so as death approached. The inspiration became more and more prolonged and laborious, and expiration shorter and more panting, with a lengthening pause between. The respiratory difficulty, which appeared to be the immediate cause of death, evidently arose from the diminishing power of the inspiratory muscles.

The *post-mortem* examination was confined to the abdomen. All the organs were healthy, except the kidneys and ureters. The right kidney was enlarged and weighed $11\frac{1}{2}$ ounces. Its surface was dotted here and there with numerous black blood-spots; but the general appearance, both on the surface and on section, was pale mottled, decidedly anaemic-looking. It contrasted strongly with the dark, almost black congested kidney found in Case I. The pelvis and ureter were not in the least dilated. They contained about two teaspoonfuls of blood-stained urine. A small uric-acid calculus was found tightly impacted in the lower part of the ureter, just above its entrance into the bladder. It was about the size and shape of a large hemp-seed, and weighed $1\frac{1}{3}$ grains.

The left kidney was found completely destroyed. It was hollowed out into a lobulated sac, about as large as the healthy kidney. On cutting it open there escaped about five ounces of an opaque white fluid, exactly resembling new milk. This singular-looking fluid retained its milky appearance, even on long standing; it was found to consist of myriads of needles of urate of soda floating in a highly albuminous serum. The sac wall consisted of a tough leathery tissue, from one to two lines in thickness, quite devoid of any recognisable renal structure. The cause of this mischief was found at the entrance into the ureter, where the channel was completely blocked up by a uric-acid stone, weighing 52 grains. The rest of the ureter was previous and normal.

The bladder was empty and healthy. The body generally was perfectly sweet and free from any urinous or ammoniacal odour.

The pathological story of this man's case was easily read even during life, and only a few details were left to be filled in at the autopsy. The left kidney was destroyed four years before by the impaction of a calculus in its ureter. The right kidney then became hypertrophied, and performed double duty in a perfect manner until another calculus blocked up the right ureter. Then the secretion of urine was suddenly and permanently arrested, and the patient died in less than ten days.

In reviewing the symptoms in this case it may be observed that insomnia and progressive failure of the muscular strength marked the entire course of the case. A certain disturbance of the stomach and slight febrile movement set in when the stone was impacted in the ureter; but these passed away after the fourth day. A fair amount of nourishment was taken up to the eighth day, after which the power of taking food almost wholly failed. The movements of the pulse, respiration, and temperature, may be seen by a glance at the following table:

	Pulse.	Respiration.	Temperature.
Third day	72	—	—
Fourth day	72	24	100
Fifth day	72	24	99.7
Sixth day	72	24	99.7
Seventh day	76	20	98.6
Eighth day	76	22	98.2
Ninth day	76	20	97.4
Tenth day	80	15	—

The pulse remained almost stationary, but with a slight tendency to increased frequency. The respiration showed a tendency to diminished frequency, especially toward the last. The temperature manifested a steady tendency to diminution, especially as death approached. This, I believe, will be found to be the general rule in uræmia. Muscular twitches were first noticed on the seventh day. At first they were slight and infrequent, but they became more and more frequent and severe as the case approached its termination. The faculties were clear to the last gasp; there

existed, however, in the last three days a constant tendency to lapse into indifference, with fitful dozing and starting, when the patient was left undisturbed. The pupils did not show decided contraction until the ninth day, and dryness of the tongue and mouth became a marked feature on the same day.

This case and Case 1 illustrate a noteworthy point in the morbid anatomy of obstructive suppression. In both of them it is noted that the ureter above the obstruction, and the pelvis of the kidney, although moderately filled with stagnant urine, were not materially dilated or enlarged. Those examples of monstrously enlarged ureter and pelvis (sacculated kidney or hydronephrosis) which are often witnessed as the effects of obstruction in the ureter are produced by slow degrees, and must be regarded as a growth rather than a simple dilatation. Indeed, the ureter and renal pelvis appear incapable of that rapid dilatation which we are familiar with in the bladder. This consideration enables us to explain how two different results may follow one and the same course, namely, obstruction in the ureter. When the obstruction is suddenly established and is at once complete, the consequence is not enlargement and sacculaion, but atrophy of the kidney and ureter. When, on the other hand, it is slowly established and incomplete, it produces hypertrophic dilatation of the ureter and pelvis, and eventually sacculation of the kidney or hydronephrosis.

CASE 3.—A man, æt. 40, had suffered three months before from symptoms of renal colic on the *right* side, and voided some small calculi. He soon recovered from this attack, and went about his business in his usual health, until three weeks before his death. He then began to suffer from pain in his *left* loin, which continued for a fortnight. During this period the urine was voided in apparently the usual quantity, but his wife noted that it had entirely changed its character. Before it had been high coloured, but now it became “clear as water.” At the end of the fortnight complete suppression of urine came on, and death ensued in five days.

I only saw this man once, on the day before his death, in consultation with Mr. Edwards, of Grosvenor Square. He was then

in full uræmia; pupils contracted to pins' points; muscular twitchings universal over the whole body; breathing panting, slow, and interrupted; tongue and mouth quite dry. He was very restless, and almost indifferent, yet he answered questions sensibly when roused. He died next day without coma or convulsions; he spoke sensibly half an hour before his death.

Autopsy next day.—The body was quite free from urinous or ammoniacal odour, and healthy in every part except the urinary organs.

The *right kidney*, which was about the normal size, was hollowed and in process of atrophy; the cortical substance alone partially remained, and this was pale and wasted. The infundibula were moderately distended, and contained about an ounce of pale fluid, which was lost. The right ureter was plugged up at its commencement by an elongated uric-acid stone weighing twenty-two and a half grains. Another little stone, as big as a hemp-seed, lay in one of the infundibula. The ureter below the plug was normal.

The *left kidney* was much enlarged, but healthy. It had the mottled appearance of the right kidney in Case 2. Three little uric-acid calculi, like flattened mustard-seeds, lay free in the infundibula. The ureter and pelvis were moderately distended with fluid; the ureter appearing about the size of a crow-quill. On slitting it open superficial abrasions were seen along its entire track, showing the footsteps of a descending calculus. Near the bladder this calculus was found, at the termination of the ureter. It slipped into the bladder during the manipulations. It was a round uric-acid stone as large as a small pea, and weighed one and a half grains.

The bladder was empty and healthy.

Though this case was seen but once the diagnosis presented no difficulties. The course of events was evidently as follows:—Three months before the fatal attack the right ureter was plugged by a calculus, the function of the right kidney was thereby permanently extinguished, and the organ at once passed on to a state of atrophy, which was nearly complete at the time of death. The left kidney

then took up the double duty, and became proportionately hypertrophied. The calculous tendency, however, was not arrested, and about three weeks before death a small calculus passed into the left ureter. It continued to descend, amid much suffering, for about a fortnight, causing partial suppression of urine. The urine voided during this period had the special characteristic of urine secreted under pressure from below, *i. e.* it was pale and watery. At the end of the fortnight the calculus had reached the terminal portion of the ureter; there it became immovably impacted, complete suppression ensued, and death followed in five days. It must be assumed in this case that during the fortnight of partial suppression a certain degree of blood-poisoning took place from the accumulation in the blood of the effete ingredients, which should have been removed by the kidneys, so that when the suppression became complete it only required five days (instead of nine or ten) to render the blood poisoned to such a degree as to be incompatible with the maintenance of life.

CASE 4.—A man, æt. 65, had been subject for some years to attacks of renal colic, and had from time to time voided uric-acid calculi. Some fourteen days before my visit symptoms of left renal colic had set in, with pain in the loin and frequent micturition. I was informed that during these fourteen days a considerable quantity of pale, clear urine had been voided, averaging altogether about two pints a day, but discharged irregularly. On some days none had been discharged, while on other days it had flowed copiously at two or three separate micturitions.

When I saw the patient he was in the last phase of uræmia; the pupils were strongly contracted; there were frequent and universal muscular twichings; pulse 100; respirations 16, markedly panting, but consciousness was intact when the attention was roused.

The hypogastrium being protuberant and dull, a catheter was introduced by Dr. Jepson, with whom I saw the case, and two pints of urine were withdrawn. This presented the usual characteristic of obstructive suppression, it was very pale, and its sp. gr. 1006.

Death took place on the fifteenth day of suppression, which,

however, had only been partial throughout. A post-mortem examination was not permitted, but it was not difficult to divine what had occurred. The right kidney had doubtless been destroyed at some previous period by the impaction of a calculus in its ureter. The left kidney, which had then become the sole organ of the urinary function, was in its turn subjected to a similar accident; a calculus entered its ureter and failed to clear the passage into the bladder, incomplete suppression ensued, and death in fifteen days.

This case is instructive in one respect, and suggestive of a caution in judging of the amount of urinary secretion. This man voided on an average about two pints of urine daily. Had this amount been of normal density and appearance, it would have indicated a degree of renal activity certainly equal to the prevention of uræmic poisoning. Patients may live for months without voiding more than fifteen or twenty ounces of urine a day, as is frequently witnessed in cases of cirrhosis of the liver and in regurgitant heart disease. But in these cases the urine is always of high density, deeply coloured, and fully charged with urinary ingredients. Here, on the contrary, the urine was pale and dilute, and the density of the specimen examined was only 1006. What amount of normal urine this represented cannot be accurately determined, but judging by the result of my analysis of the urine passed under similar circumstances in Case 1, the urea would not amount to more than about one grain to the ounce. Calculating on this basis, this man excreted only forty grains of urea per day, which is not more than one tenth of the normal amount. Another point in the case deserves notice as being more or less constantly characteristic of the mode of emission of urine in obstructive suppression; this was the irregularity of the times of discharge. Although the patient in this case discharged an average quantity of two pints a day, this was not voided with that approach to regularity which marks the normal state, but most irregularly; one day no urine at all would be voided, the next day it would be voided copiously two or three times, then again none at all for two or three days, and so forth. I have

noticed this paroxysmal character of the urine-discharge in all my cases of obstructive suppression, and I believe it to be a point of considerable diagnostic value.

The two following remarkable cases show that recovery is possible even after very protracted suppression of urine, provided the flow of urine can be re-established. The notes of the two cases were furnished to me by Dr. Clifford Allbutt, of Leeds, and Dr. Duigan, of Gainsborough, respectively. In the first case the suppression continued for nearly ten days, and in the second for nine days. In neither case were twitchings of the muscles noted, but the pupils had become contracted in Dr. Allbutt's case, and there was some mental confusion. From my own experience I should regard muscular twitchings as *the* first really undoubted and characteristic symptom of uræmic poisoning; it cannot, therefore, be said that recovery followed in either case after the full declaration of uræmic symptoms. Another apparently well-authenticated case of recovery after nearly ten days' total suppression, of obscure nature, is recorded in the tenth volume of 'Edinburgh Medical and Surgical Journal,' p. 409.

Mr. W.—, a healthy vigorous man of about 56, was first seen by Mr. Wheelhouse, on Wednesday, September 11th, 1867. He complained of great lumbar pain, weight, sense of fulness, sickness, and febrile disturbance.

Monday, 16th.—Symptoms of descent of calculus along ureter commenced.

Saturday, 21st.—During this time stone apparently traced along ureter.

October 2nd.—Stone from last date till now seemed to be impacted at entrance into bladder, constant pain augmented in paroxysms till 3 a.m. this morning, when sudden and entire relief was felt, and the patient was told how to look for symptoms of stone in the bladder. At 6 a.m. he passed the last quantity of urine, about $\frac{5}{6}$ ij. Up to this time the flow had been free and the fluid normal.

3rd, 9 a.m.—No urine passed. Catheter used, but no obstruction found. Bladder quite empty. 3 p. m.—Same state.

Perfect freedom from pain, no urine. No symptoms of uræmia. 10 p.m.—Consultation with Dr. Allbutt. Same state. Temperature 100°. Hot bath and fomentations ordered.

4th (Friday), 9.30 a.m.—Same state. No urine. No uræmia. Much local uneasiness and restlessness. Temperature 98°2. Fomentations, saline purgatives and diluents. Bromide of potassium with a little iodide given as a sedative, opium being inappropriate. 9 p.m.—Same state. A drop or two of urine had been excreted out, just enough to make a stain at the bottom of a small vessel. No symptoms of poisoning. Patient quite clear and much more comfortable.

5th.—Mr. W. summoned at 5 a.m. Much pain at the old point; cramped limb of same side; not a drop of urine though frequent solicitations; firm pressure on part gives relief. Sp. Eth. Sulph. ordered every half hour. 8.30—Seen with Dr. Allbutt. Pain subsided after a few doses of ether; no urine; breath sweet; perspiration normal. On examination whole left side of belly from middle line dull; left rectus tense; dulness varies a little with position. Patient clear and intelligent; no drowsiness. Ether and bromide omitted. 3 p.m.—Same condition; pain returning; no urine; no uræmia. 9.30—Seen with Dr. Allbutt. Physical examination:—Dulness over whole of hypogastrium below a cross line drawn through the navel; dulness little affected by position. Examination per rectum showed only a tender spot behind the prostate; no bulging; catheter passes freely, and is moistened with a few drops of urine, perhaps twenty or thirty drops; upon the end of it is a little bloody mucus. Breath decidedly urinous; mind clear; no headache. Pulse weaker and quickening a little. Pulse and temperature have been normal.

6th, 9.30.—Pulse 96, better; temperature 98°2. Had passed a fair night; no urine. Dulness of belly extends a little above navel on left side, but not extending so far to the right as yesterday. Breath *not* urinous. Bowels have been kept open by salts till to-day, when no motion was reported. 9.30 p.m.—Singularly clear in head; placid sleep for five hours. Two watery stools. No urine, unless it be a very few drops passed after

repeated efforts ; is cheerful, and walks about the room easily, and is well able to sit down and rise. A little cough which he has seems to shake and hurt the lower belly. Tongue coated, but food taken fairly in small quantities. Has had for instance a little partridge to-day. Pulse and temperature normal. Breath sweet. Ankles not puffy. Dulness all over hypogastrium.

7th, 9.30 a.m.—Good night. Pulse natural. Temperature 97°. No stupor or headache. Sense of a moveable tumour in lower abdomen. A few drops of urine, perhaps a tea-spoonful, accumulated after repeated efforts. 10 p.m.—Complains of weight at lower belly on left side, and pain there on coughing. Sickly during the day. Pulse and temperature normal. No uræmic symptoms.

8th, 9th, and 10th.—Same report, unless there be a little drowsiness and tendency to be a little "lost" at times.

11th.—This morning a little urine was passed, quantity not recorded. There is a good deal of mental oppression, especially after awaking. Aspect dull and heavy. Pupils contracted. Dulness of abdomen about the same ; it is a little increased on left side, but diminished a little to the right. He has been purged to-day without medicine.

12th.—Has passed 3ivss of water, and there is a little less mental obfuscation. Has had a warm bath, which relieved him in every way. Is still purged also, an action which is not prevented. Tongue loaded, appetite nil. Temperature normal.

13th.—Marked improvement ; a copious flow of urine last night. The head clear ; a refreshing night. Some return of appetite. Abnormal dulness much diminished.

14th and 15th.—A good deal of pain, dragging and paroxysmal ; chiefly in the old place, above and to left of pubis ; is irritable and restless ; expression worn and anxious. There is no pain at the end of the penis. Pulse 100, weak. Temperature 100. As the water is now very abundant, we are able to give him champagne and morphia injections, which with warm water baths relieve him. Is still purged.

16th and 17th.—Pains cease. No stone is discovered. Convalescence.

21st.—May be considered well. Functions normal. Appetite good. No dulness in abdomen.

I strongly suspect that the suppression in this man was not due to the impaction of a calculus in the ureter, as seems to have been the impression of Mr. Wheelhouse and Dr. Allbutt, but to the existence of a double hydronephrosis, and that the case was similar, pathologically, to one which fell under my notice some three years ago, and which will be related presently (see Case 7). Temporary suppression of urine, extending over some days, followed by copious flow of urine, is a distinctive feature of cases of hydronephrosis; and the extensive dulness in the abdomen, which disappeared after the urine began to flow, can (the bladder being empty) scarcely be otherwise explained.

In the next case, however, the suppression was undoubtedly due to the impaction of calculi in the ureter, and ceased when the stones were voided.

CASE 6. (From the notes of Dr. Duigan.)—The patient was a strong, stout, middle-aged cattle-jobber, living in the country. He had often suffered from renal colic and had frequently passed urine-acid calculus. The attack began with pain in both loins, and the patient had had complete suppression for three or four days when first seen by Dr. Duigan, in consultation with Dr. Smallman of Willingham. The pain had then completely subsided, and, except for loss of appetite and the suppression, the man presented no marked symptoms. The introduction of a catheter showed that the bladder was empty. For nine days he continued in this state, never passing any urine for all that time, and not suffering from any bad symptoms, sickness, or other indication of uræmie poisoning. At the end of this period the kidneys began to act, and he passed a quantity of clear urine of low specific gravity, containing nothing abnormal. With this urine he voided three or four urine-acid calculus, and shortly after got quite well.

In this case it is probable that one kidney had been destroyed at some former period by the impaction of a calculus in its ureter; at the same time it is not absolutely impossible, as Dr. Duigan suggests, though, I think, highly improbable, that both kidneys

may have been sound, and that both ureters were obstructed by calculi at the same moment.

CASE 7.—A youth of twenty had suffered since boyhood from reeurrent attacks of intestinal obstruction extending over four or five days, then relieved by copious alvine evacuations. I was called to see him in one of these attacks with Mr. Jonathan Wilson and my colleague, Mr. W. Smith. There had been no stool for five days, and the urine was reported to be exceedingly scanty, amounting to no more than six or eight ounces in the twenty-four hours.

On the next day (March 1st) he passed four ounces of urine, it was discoloured with blood, and its sp. gr. was 1008. On examining the loins both were found dull on percussion, bulging and elastic, quasi-fluctuating. The intestinal obstruction still continued. The opinion was hazarded that the patient was the subject of double hydronephrosis, in other words, that the kidneys were hollowed out and distended with accumulated urine, which was unable to escape from some long-standing impediment in the ureters. The constipation, it was conjectured, was occasioned by the pressure of one or other distended kidney upon some portion of the colon adherent thereto.

On the following day three ounces of similar urine (except that it was freer from blood) were voided, but on the succeeding day no urine was passed.

At this date (March 3rd) the condition of matters was as follows:—the bowels had not acted for eight days; for the first five days six to eight ounces of urine had been voided, on the sixth day four ounces, on the seventh day three ounces, and none at all on the eighth day. On the ninth day several very copious discharges of urine took place, amounting altogether to more than eight pints. These specimens of urine had all the same character, they were pale and watery, sp. gr. ranging from 1005 to 1007, free from albumen, and only containing microscopic quantities of blood. A sensible softening of the abdomen had now taken place, and the elastic swelling on the left side was very decidedly diminished. Considerable relief followed, and the patient slept

several hours, but the bowels still remained unmoved in spite of enemata of oil and gruel and repeated kneading of the abdomen.

On the tenth day great discharges of urine took place, fully eight pints altogether. In character it exactly resembled that of yesterday. At midnight the bowels yielded, and enormous quantities of semi-liquid faeces were evacuated.

On the eleventh day several copious motions took place, and it was now hoped that recovery would ensue. It was, however, noted that no urine had been voided for twelve hours and that the general condition of the patient was far from reassuring. The loins still presented the same elastic bulgings, which were perhaps even more distinct from the subsidence of the general bulk of the abdomen. The tongue was also dry and sordes were beginning to accumulate about the teeth.

On the thirteenth day the general symptoms were still more alarming. Great prostration existed, the patient was indifferent and scarcely answered questions; the pulse rose rapidly; the teeth were covered with sordes, and the urine was totally suppressed.

On the fourteenth day death took place, immediately preceded by a fit of convulsions. The patient had been in a state of typhoid coma for about twelve hours before, and no urine had been passed for sixty hours.

When the body was opened both kidneys were found hollowed out, and converted into two enormous lobulated sacs. The left was ten inches long by about seven broad, and almost filled the left half of the abdomen; the right kidney was about a quarter less. When they were cut open the pyramidal part of the kidneys were found totally absorbed, and only a thin layer of cortical substance, forming walls of the sacs, remained. The descending colon was adherent for the space of three inches to the left kidney. The bowel was contracted at this spot, and tightly stretched over the distended kidney in such a manner as to prevent the free passage of the faeces.

When the kidneys were examined the cause of the obstruction was found to be different on the two sides. On the left side there was a narrowing of the ureter at its commencement, which was so contracted that it would only admit a very small probe. Its origin

from the pelvis of the kidney, which was enormously dilated and globular, was also oblique, so that a valve-like obstruction was thereby constituted. The action of the latter impediment was clearly revealed, when the sacculated mass was held in the hands and subjected to various degrees of pressure. With moderate pressure no urine escaped by the ureter, but when the mass was strongly compressed the obliquity of the origin of the ureter was for the time effaced and the urine escaped freely. The same thing doubtless happened during life. When the distension was moderate the course of the urine was obstructed, but when the urine accumulated, until the distension became very great, the obstruction was at length overcome and the contents of the sac escaped. The narrowing at the orifice of the ureter was probably congenital, and constituted from birth a slight impediment to the free escape of urine. In the course of years it produced dilatation of the pelvis and subsequently hollowing of the kidney in consequence of the accumulation and stagnation of urine above the obstruction. As the pelvis enlarged and became distended with accumulated urine it acquired a more globular form, and the orifice of the ureter was, in consequence, carried upwards and assumed an oblique direction, so that an additional obstacle to the escape of urine was thereby created, and one which could only be overcome at intervals, when the pressure from behind became extreme.

The mechanical cause of the obstruction on the right side was due to an abnormal distribution of the renal artery. An irregular branch of the artery passed downwards toward the lower parts of the kidney, and in its course crossed in front of the ureter just below its origin. The slight but constant pressure of this branch evidently produced a certain degree of constriction of the ureter, and thus constituted a permanent hindrance to the escape of urine. In process of time this brought about, just as on the opposite side, stagnation of urine above the obstruction, dilatation of the pelvis and infundibula, and eventually sacculation of the kidney.

The cause of death in this patient was evidently not due solely to the urinary obstruction. The retention of faeces for a period of

ten days must have contributed something to the blood poisoning which ultimately carried him off. The case illustrates in a most marked manner the rule which I have pointed out respecting urine secreted under pressure from below, namely, that it is conspicuously watery, and of low specific gravity.

CASE 8.—A man, æt 59, was visited by me with Dr. Herbert Renshaw, of Sale, on July 10, of this year. Six months ago he began to suffer pain in his back, loss of appetite, failure of strength, and constipated bowels. The pain in the back was of a constant and severe aching character, requiring endermic injection of morphia for its relief. The urine was pale and abundant, but discharged irregularly. It did not at any time up to my visit contain blood or albumen.

A month ago the patient had total suppression of urine for four days. This was overcome by compulsorily walking him about between two assistants. The urine returned and the pain subsided. After this, however, the discharge of urine was extremely irregular, and it was noticed that when the urine flowed freely the pain in the back was relieved, and that the pain became aggravated when the urine was for a time suppressed.

After the above-mentioned four days' suppression he recovered a good deal, and went to Southport. There he was attacked with diarrhoea, and had to return home in consequence.

At the date of my visit he was suffering severely from the pain in the back; he was very weak and the legs were slightly œdematos. He was then passing from one to two pints of a dilute urine daily; this contained a trace of albumen. I requested that all the urine which the patient voided should be collected and brought to me day by day, for the next three days. The first day he voided two pints, the second day one pint, and the third day eight ounces. For the next three days the urine was totally suppressed, and he died. The specimens of urine were all alike; they were pale and watery, the specific gravity ranged from 1009 to 1010, they were acid, and contained a trace of albumen.

The symptoms during the last three days of life were as follows, according to the statements of Dr. Renshaw and the patient's wife,

for I only saw him once myself:—Increased weakness, marked panting breathing; diarrhoea for the last two days; twitchings of the muscles; rambling delirium when left to himself, but perfect consciousness to the last when his attention was roused; no coma, no convulsions.

Autopsy.—Body quite free from urinous or ammoniacal odour. All the organs were healthy except the urinary apparatus. The source of mischief was found to be a hard scirrhouss mass, as large as an orange, which half filled the pelvis. This growth involved the base of the bladder and the prostate gland. The rectum was adherent to it and constricted for the space of an inch; but I could get two fingers through the narrowest part. The seat of the scirrhouss growth in the bladder was the submucous tissue. Neither the mucous nor peritoneal coats were implicated, though much puckered and folded, owing to the contraction of the thickened wall of the bladder. The whole trigone was involved, and the disease extended for a full inch above the trigone, terminating in a thick, abrupt rim or border. The walls of the bladder in the implicated region measured from half to three quarters of an inch in thickness. The fundus of the bladder was quite healthy, and the organ was capable of containing about half a pint of urine. The urethra for the length of an inch passed through the dense mass of the prostate, which was fully an inch and a half thick. The channel was quite free, a catheter had been repeatedly passed during life without any difficulty.

The terminal portions of both ureters passed for the length of an inch through the scirrhouss mass; their course in this part was tortuous, and their channel compressed by the surrounding growth, but a probe could be passed through both of them, showing that neither was completely occluded. Above the bladder both ureters were dilated to the size of the little finger (the left more than the right), and distended with urine. The *left kidney* was greatly atrophied and weighed only $2\frac{1}{2}$ oz.; the interior was hollowed, without trace of pyramids, and the cortical substance was reduced to a fleshy rim of tissue of homogeneous appearance. The *right kidney* was enlarged, and weighed 7 oz.; it was hollowed, but not

so completely as its fellow. The pyramids were gone, and the cortical substance was undergoing absorption. The pelvis was enlarged to the size of an egg, and distended with urine.

It was evident that the left kidney had not done any duty for some months, and that life had been sustained by the hypertrophied right kidney until this also was blocked up by the progress of the growth in the bladder.

The tumour had contracted adhesions to, and made extensions into, the adjacent parts in the pelvis. The iliac vessels passed through a dense scirrhouss mass, whereby they must have been more or less compressed ; this was probably the cause of the œdema of the legs.

My notes of the next two cases are exceedingly imperfect, but as each of them illustrates some point in the history of obstructive suppression, I will add them to the series.

CASE 9.—This was an old lady of about sixty whom I saw with Dr. Gardiner of Ashton. She was afflicted with cancerous disease of the uterus and vagina, involving the base of the bladder and (presumably) implicating the terminal portions of the ureters. When I visited her no urine had been passed for four days, and the suppression continued without interruption for three days longer, altogether a total of seven days. After this the urine returned and flowed normally for the remaining four weeks during which she lived. During the time of suppression there was great restlessness and insomnia, with a flushed and anxious expression of countenance, but no twitchings of the muscles, and no convulsions nor coma. There was no autopsy. Seven days of suppression of urine, without the development of uræmic symptoms, and issuing in recovery so far as the suppression was concerned, is, as we have seen, not an unprecedented occurrence. It may be conjectured that in this case one ureter was permanently occluded by the morbid growth ; and that during the epoch of suppression the opposite ureter had become blocked up, probably by a fungous excrescence projecting into its calibre, and that an ulcerative process at the end of seven days again cleared the passage. This is a process analogous to that which not unfrequently happens in

scirrhus of the pylorus, when the strictured state prevailing in the earlier periods is afterwards opened out by the softening and ulceration of a portion of the cancerous mass.

CASE 10.—A man of about 35, greatly given to alcoholic excesses, was seen by me, with Mr. Hunstone of Strangeways, on January 15th, 1869. He had then passed no urine for four days. He was somewhat stout, and both loins were doubtfully thought to be the seat of bulging, of an elastic, quasi-fluctuating character. The previous history threw no light whatever on the nature of the case. There were no uræmic symptoms, but a great sense of tension of the abdomen. I saw this man on three successive days, and introduced a tubular needle to the depth of three inches into one of the lateral bulgings, but without reaching any collection of fluid. The notion I entertained was that a double hydronephrosis existed, and that the swellings in the loins were the sacculated kidneys distended with urine. He died two days after my last visit. No post-mortem examination was permitted. The suppression lasted nine days, and during that period only about an ounce of urine was voided. Mr. Hunstone states that this was pale. Up to the seventh day of suppression there were no twitchings of the muscles nor marked contraction of the pupils. The information respecting the final symptoms is defective. There was great restlessness and insomnia. Consciousness was maintained to the last, and the patient asked to be prayed with just before his death.

The *duration of life* in complete obstructive suppression appears to range, as a rule, from nine to eleven days, and the passage of a few ounces, or even two or three pints, of a dilute urine does not seem to extend the time of survivorship beyond a few hours. I have not discovered more than two well-authenticated cases in which the suppression was complete, or approached completeness, where the patient survived beyond the eleventh day. The first of these is recorded by Rayer ('Mal. des Reins,' t. iii, p. 490). He was a man of sixty-four years of age, who had hydronephrosis of the right kidney of many years' standing. The ureter of the

left kidney was bloeked np by a caleulus, and suppression of urine ensued. This proved fatal in twenty-five days, and in that interval only two ounées of urine were voided. The seeond ease is deseribed by Mr. Paget in the seeond volume of the 'Transactions of the Clinical Soeity.' The patient was seventy-three years of age. The right kidney was atrophied and apparently ineapable of seereting any normal urine. The left kidney was hypertrophied and the ureter bloeked by a stone. Complete suppression ensued for thirteen days. No symptoms of uræmie poisoning appeared until the last of these thirteen days, when a slight attaek of eonvulsions oecurred. Then, on the fourteenth day, he passed an uneertain but "eon siderable" quantity of urine, and again six ounées on the same day; some slight convulsive movements whieh had been obseved during the day then eased. From this period until his death, seven days afterwards, the suppression was complete, and no urine was found in the bladder after death. So that there was total suppression for twenty-one days, only interrupted by one day's emission of urine. Muscular twitehings made their appearance on the sixteenth day. Mr. Paget attributed the extraordinary pro traetion of life in this ease mainly to the patient's advanced age; but this view is seareely borne out by other experience. My first patient was sixty-seven—only six years younger than Mr. Paget's ease, yet he only survived nine and a half days, though he seereted sixty ounées of urine in that period.

There are, indeed, other eases on record, in the more aneient literature of medieine, in whieh patients are alleged to have survived many months of total suppression of urine; but it may be safely affirmed that imposition of some sort or other was praetised in these eases.

Treatment.—Our notions of the treatment must vary according to the nature of the obstruction. Taking first those eases which are due to impaetion of a stone in the ureter, it must appear that the use of ordinary diureties eannot avail against a physical obstaele. There is something to be said in favour of means direeted to excite the eontraetile power of the ureter. In my second case Dr. Garrod suggested, with this view, the use of

turpentine, but it provoked vomiting and could not be persevered with. Or remedies of an opposite class might be alternately tried with the purpose of relaxing the spasm of the ureter, such as opium, chloroform, belladonna, venesection, and warm baths. My own impression, however, is more in favour of mechanical means ; and in reviewing the cases which have fallen under my notice, I cannot help thinking that something further might have been attempted in this way with a prospect of advantage. One such means, namely, kneading or shampooing the renal region and the course of the ureter, was in two of my cases followed by a so immediate, though only transient, flow of urine, that I could scarcely doubt that it was due to the means employed. But in a large number, if not the majority of cases the impaction takes place near the bladder where no direct force can be applied. Indirect means may, however, be tried. The physical condition is generally this :—Above the calculus the ureter is open and distended with stagnant urine ; at the seat of the lodgment, and below it, the ureter is contracted. A displacement either upwards or downwards would be likely to be followed by relief. To provoke this succession of the body and various changes of posture might be tried. The patient should be directed to support himself from time to time on his knees, with the upper half of the body depressed, and the sacrum might be repeatedly struck with the fist. The force of gravity would thus be brought in aid to coax the obstacle back toward the kidney. Or walking the patient between two assistants up and down stairs and about the room might be practised in the earlier periods of the case, with the object of facilitating the descent of the calculus into the bladder. Means of this class should be persevered in to the end, for experience is warrant that hopes may be entertained, even almost to the last, that the obstruction may be yet overcome.



